AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (currently amended): Radiographic equipment comprising:

a first neutron source of substantially mono-energetic fast neutrons produced via the deuterium-tritium or deuterium-deuterium fusion reactions, comprising a sealed-tube generator for producing the neutrons;

a ~~separate~~ source of X-rays or gamma-rays of sufficient energy to substantially penetrate an object to be imaged, the source of X-rays or gamma-rays being physically separated from the first neutron source;

a collimating block surrounding the neutron source and the X-ray or gamma-ray source, and comprising one or more slots for emitting substantially fan-shaped radiation beams;

a detector array comprising a multiplicity of individual scintillator pixels to receive neutron radiation and X-ray or gamma-ray radiation emitted from the respective sources and to convert the received radiation into light pulses, the detector array aligned with the fan-shaped radiation beams emitted from the source collimator and collimated to substantially prevent radiation other than that directly transmitted from each of the sources from reaching the array;

convertor for converting the light pulses produced in the scintillators into electrical signals;

conveyor for conveying the object between each of the sources and the detector array;

computing device for determining from the electrical signals the attenuation of the neutrons and the X-ray or gamma-ray beams and to generate output representing the mass distribution and composition of the object interposed between each of the sources and detector array; and

display for displaying images based on the mass distribution and the composition of the object being scanned.

2. (previously presented): Radiographic equipment according to claim 1, where the X-ray or gamma-ray source comprises a ^{137}Cs, ^{60}Co or similar radioisotope source having an energy of substantially 1 MeV.

3. (previously presented): Radiographic equipment according to claim 1, where the X-ray or gamma-ray source comprises an X-ray tube or electron accelerator producing X-rays through Bremsstrahlung on a target.

4. (previously presented): Radiographic equipment according to claim 1, where the neutron source produces neutrons having substantially higher energies than the X- ray or gamma-rays from the X- ray or gamma-ray source, where the neutron and X-ray or gamma-ray sources are arranged to pass through the same slot in the collimating block and a single detector array is used, comprising individual pixels of plastic or liquid organic scintillator, where discrimination

between the X-rays or gamma-rays and the neutrons is made on the basis of the energy they deposit in the scintillator.

5. (previously presented): Radiographic equipment according to claim 1, where the sources of neutrons and X-ray or gamma-rays are arranged to pass through the same slot in the collimating block and a single detector array is used comprising individual pixels of plastic or liquid organic scintillator, where the neutron and X-ray or gamma-ray sources are operated alternately.

6. (previously presented): Radiographic equipment according to claim 1, where the sources of neutrons and X-ray or gamma-rays are arranged to pass through separate parallel slots in the collimator block and two detector arrays are used, one comprising individual pixels of plastic or liquid organic scintillator for the detector of the neutrons and one comprising individual pixels of plastic, liquid or inorganic scintillator for detection of the X-rays or gamma-rays.

7. (previously presented): Radiographic equipment according to claim 4, where each slot of the source and detector collimators are sufficiently wide to ensure full illumination of the detectors by the source, whilst minimising the detection of scattered radiation.

8. (previously presented): Radiographic equipment according to claim 1, further comprising a second sealed tube or similar neutron generator for producing neutrons via either the deuterium-

tritium or deuterium-deuterium fusion reactions, where the second source of neutrons uses a complementary fusion reaction to the first neutron source.

9. (previously presented): Radiographic equipment according to claim 8, where the neutrons from the second neutron source are detected in a separate collimated detector array comprising individual pixels of plastic or liquid organic scintillator.

10. (previously presented): Radiographic equipment according to claim 9, where one of the first neutron source or the second neutron source has an energy of substantially 14 MeV and the other has an energy of substantially 2.45 MeV.

11. (previously presented): Radiographic equipment according to claim 1, where the convertor comprises a plurality of photodiodes, wherein the scintillator material is selectable to have an emission wavelength substantially matched to the response of the photodiodes.

12. (previously presented): Radiographic equipment according to claim 1, where the convertor comprises crossed wavelength shifting fibres coupled to a multiplicity of single or multi-anode photomultiplier tubes.

13. (previously presented): Radiographic equipment according to claim 11 , where the electrical signals from the convertor indicate the transmission of the first neutron source and the X-rays or

gamma-rays through the object being scanned, or the transmission of the neutrons from the first neutron source, the X-rays or gamma-rays and the neutrons from a second neutron source through the object being scanned.

14. (previously presented): Radiographic equipment according to claim 13, where mass attenuation coefficient images for each pixel are computed based on the respective transmissions and displayed with different pixel values mapped to different colours, where the image is indicative of the mass distribution and composition inferred from the computations.

15. (previously presented): Radiographic equipment according to claim 1, where the computing device comprises a computer to perform image processing and display the images on a computer screen.

16. (previously presented): Radiographic equipment according to claim 15, where the output is convertable to mass-attenuation coefficient images for each pixel for display on a computer screen with different pixel values mapped to different colours.

17. (previously presented): Radiographic equipment according to claim 16, where the mass-attenuation coefficient images are obtainable from count rates measured from the transmissions for each of the deuterium-tritium neutrons or deuterium-deuterium neutrons and X- rays or

gamma-rays, or the deuterium-tritium neutrons, deuterium-deuterium neutrons and X- rays or gamma-rays.

18. (previously presented): Radiographic equipment according to claim 17, where the computer is operable to obtain cross section ratio images between pairs of mass attenuation coefficient images.

19. (previously presented): Radiographic equipment according to claim 18, where the proportions in which the cross section ratio images are combined are adjustable to maximise contrast and sensitivity to a particular object being examined in the image.

20. (previously presented): Radiographic equipment according to claim 18 , where the computer is able to perform automatic material identification based on the measured cross sections.

21. (previously presented): Radiographic equipment according to claim 19, where the proportions in which the cross section ratio images are combined are operator adjustable.

22. (previously presented): Radiographic equipment according to claim 1, where the sources and the detector array are stationary and the conveyor is arranged such that the object is able to be moved in front of the source of neutrons.

23. (previously presented): Radiographic equipment according to claim 1, where the object is stationary and the conveyor is arranged such that the source and the detector array move in synchronicity on either side of the object.

24. (canceled).

25. (previously presented): Radiographic equipment according to claim 1, where multiple views are obtained by either rotating the object relative to the sources and the detector array or by rotating the sources and the detector array relative to the object.

26. (previously presented): Radiographic equipment according to claim 1, where the intensity of the first neutron source is of the order 10^{10} neutrons/second or greater.

27. (previously presented): Radiographic equipment according to claim 11 where the scintillators are surrounded by a mask to cover at least a portion of each of the scintillators, each mask having a first reflective surface to reflect escaped light pulses back into the scintillator.

28. (new): The radiographic equipment according to claim 1, wherein the first neutron source has a deuteron energy of less than about 200 keV.

29. (new): The radiographic equipment according to claim 28, wherein the deuteron energy is within a range of about 80 keV to about 110 keV.

30. (new): The radiographic equipment according to claim 1, wherein the detector array comprises:

a first detector array comprising a plurality of scintillator pixels to receive neutron radiation emitted from the first neutron source and to convert the received neutron radiation into light pulses; and

a second detector array comprising a plurality of scintillator pixels to receive X-ray or gamma-ray radiation from the source of X-rays or gamma-rays and to convert the received X-ray or gamma-ray radiation into light pulses.

31. (new): A radiographic equipment comprising:

a first source which produces substantially mono-energetic fast neutrons by a deuterium-tritium or deuterium-deuterium fusion reaction, the first source having a deuteron energy of less than about 200 keV;

a second source which produces X-rays or gamma-rays of a sufficient energy to substantially penetrate an object to be imaged, the second source being physically separated from the first source;

a collimating block which surrounds the first source and the second source, the collimating block comprising at least one slot, each slot for emitting substantially fan-shaped radiation beams;

a first detector array comprising a plurality of scintillator pixels for receiving neutron radiation which is emitted from the first source and passes through the object to be imaged, and for converting the received neutron radiation into first signals;

a second detector array comprising a plurality of scintillator pixels for receiving x-ray or gamma-ray radiation which is emitted from the second source and passes through the object to be imaged, and for converting the received x-ray or gamma-ray radiation into second signals;

a computing device which determines an attenuation of the mono-energetic fast neutrons and the X-rays or gamma-rays, respectively, based on the first signals and the second signals, and generates an output representing a mass distribution and composition of the object to be imaged; and

a display which displays images based on the mass distribution and the composition of the object to be imaged.

32. (new): The radiographic equipment according to claim 31, wherein the deuteron energy is within a range of about 80 keV to about 110 keV.